FINAL
~~DRAFT~~ REPORT
TECHNICAL DOCUMENT REVIEW
CPS/MADISON INDUSTRIES
MIDDLESEX COUNTY, NEW JERSEY

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Waste Programs Enforcement
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Prepared By	: CDM Federal Programs Corporation
Work Assignment Project Manager	: John P. Mihalich
Telephone Number	: (212) 393-9634
Primary Contact	: Pat Evangelista
Telephone Number	: (212) 264-6311
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EXECUTIVE SUMMARY

Due to high levels of zinc, lead, cadmium, methylene chloride, 1,1,2,2-tetrachloroethane, and other volatile organic compounds (VOCs) found in groundwater, soil, surface water, and sediment in the Pricketts Brook watershed, a Remedial Investigation and Feasibility Study (RI/FS) is being conducted at CPS/Madison. Several remedial actions have been proposed to restore the watershed to its natural conditions.

The Pricketts Brook watershed, located in Middlesex County, New Jersey, is the sole water source for Old Bridge, Perth Amboy, and Sayreville.

In a 1981 Administrative Order brought to suit by NJDEP and Perth Amboy, two companies upgradient from the Runyon well field were held responsible for the damage. CPS Chemical Commpany (CPS) is responsible for polluting the watershed with VOCs, while Madison Industries (Madison) is responsible for the heavy metal pollution.

The 1981 Order mandated that the responsible parties install a slurry wall around the perimeter of the plumes of contamination, to be keyed into a subsurface impermeable clay layer (the "bath-tub" plan).

The plan included additional remedial actions such as the rerouting of Pricketts Brook and the excavation of Pricketts Pond sediments.

Following the Order, consultants for the companies determined that the clay layer is discontinuous and would therefore not enclose the contamination. Rather than key into a deeper continuous clay layer (a much more costly alternative), the consultants designed a shorter, crescent shaped slurry wall which would be keyed into a locally continuous clay layer.

Perth Amboy initially refused the idea of a shaped slurry wall ~~the~~ crescent due to their concern that it would not contain the contamination and that an option should not be considered merely because it's more cost-effective. While Perth Amboy has blamed the companies for the cleanup delay, the companies have blamed Perth Amboy. ~~The public has criticized NJDEP.~~

A second Order was signed in April 1988 mandating the companies to implement a remedial plan which includes the crescent shaped slurry wall.

At the request of EPA, CDM Federal Programs Corporation (CDM FPC) has reviewed the CPS/Madison documents for technical accuracy and regulatory compliance with regard to CERCLA, SARA, and the NCP, as well as EPA guidance on conducting RI/FSs.

CDM FPC provides "comment" paragraphs, where applicable, at the end of each section to summarize our concerns, with regard to technical accuracy and regulatory compliance. These conncerns include the following:

- CDM FPC is aware of the fact that a remedial design has already been chosen and does not intend to cause any further delay. However, the documents reviewed by CDM FPC indicate that, generally, ony two remedial designs (the "bath-tub" and the crescent shaped slurry wall) were

considered. There is no indication that other remedial alternatives, such as the construction of an infiltration basin, were considered.

- The current nature and extent of contamination must be clearly defined. The plumes of contamination which have been used as a basis for remedial design are based on NJDEP data from 1982. A complete round of sampling must be conducted before implementation of the plan.

- The samples must be analyzed for the Target Compound List (TCL) pollutants in accordance with the Contract Laboratory Program (CLP). To date, the data has been validated only once (in 1982) to the State's Tier 2 level. The Tier 2 level data is less valid than the State's Enforcement Quality level data. The Enforcement Quality level is equivalent to the EPA's CLP.

- An health assessment must be completed by ATSDR.

- A risk assessment should be completed as per the Superfund Public Health Evaluation Manual (SPHEM) (EPA, October 1986).

- A community relations plan (CRP) must be implemented.

- ARARs must be continually updated as remedial actions proceed in order.

- Lead and support agencies should continually oversee the remedial actions to ensure technical accuracy and regulatory compliance.

- Lead and support agencies should be reminded of SARA (Section 116) which emphasizes a fast pace of cleanup. Contamination of groundwater was originally identified in the early 1970's and the site is still awaiting remediation.

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1.0 INTRODUCTION

1.1 SITE BACKGROUND

CPS Chemical Company (CPS) and Madison Industries Inc. (known as Food Additives, Inc. prior to 1975) are in Old Bridge Township, Middlesex County, New Jersey. Both facilities were constructed in 1967 and are still active. CPS is engaged in the processing, conversion, and storage of various alcohols, esters, and other organic compounds while Madison Industries is engaged in the production of zinc chloride and other chemical compounds.

The CPS/Madison site is on the southeast side of Old Waterworks Road approximately 2 miles south of Ernston and 1.5 miles west of Route 9 (Figure 1). The site is situated northeast of the Runyon well field and pumping station. This well field consists of several suction lines ~~of wells~~ in the area of Tennents Pond (formerly Runyon Pond).

The City of Perth Amboy receives its potable water supply from these wells. In 1971, a portion of the well field (the Bennet Suction Line) was taken out of service due to the detection of pollutants during routine sampling. In 1972, the State ordered a total shutdown of the suction line. In 1973, Pricketts Pond was excavated to supplement the aquifer recharge capability of nearby Tennent Pond to the south.

The CPS/Madison site is within the Pricketts Brook watershed, an area of approximately 1.8 square miles. Pricketts Brook originates approximately 2 miles upstream of Tennents Pond in broad marsh which drains much of the surrounding area. The Brook flows through the CPS and Madison properties and continues for approximately 700 feet to the Pricketts Pond inlet. The Madison Township Sewer Authority's (MTSA) industrial sewerline runs through the CPS and Madison properties, roughly parallel to Old Waterworks Road.

1.2 HYDROGEOLOGY

The hydrogeologic information contained within this report is largely based on Wehran (1983) which summarizes earlier reports on subsurface investigations. Other more recent reports were consulted for additional hydrogeologic information.

The CPS/Madison site is in a relatively low lying area of Old Bridge Township which drains in a southwesterly direction. The area is underlain by the Raritan Formation (Cretaceous age) which consists of, from lowest to highest, the Farrington Sand, the Woodbridge Clay, the Sayreville Sand, the South Amboy Fire Clay, and finally, the Old Bridge Sand.

The Farrington Sand is the lowest unit of the formation, which overlies bedrock. The Farrington Sand has had an increasing salt water intrusion problem due to the construction of a canal on the South River which cut into the aquifer and subjected it to tidal influence of the Raritan Bay.

Overlying the Farrington Sand is the Woodbridge Clay, which is a gray to dark gray micaceous silt clay and very fine sand with frequently occurring lignite.

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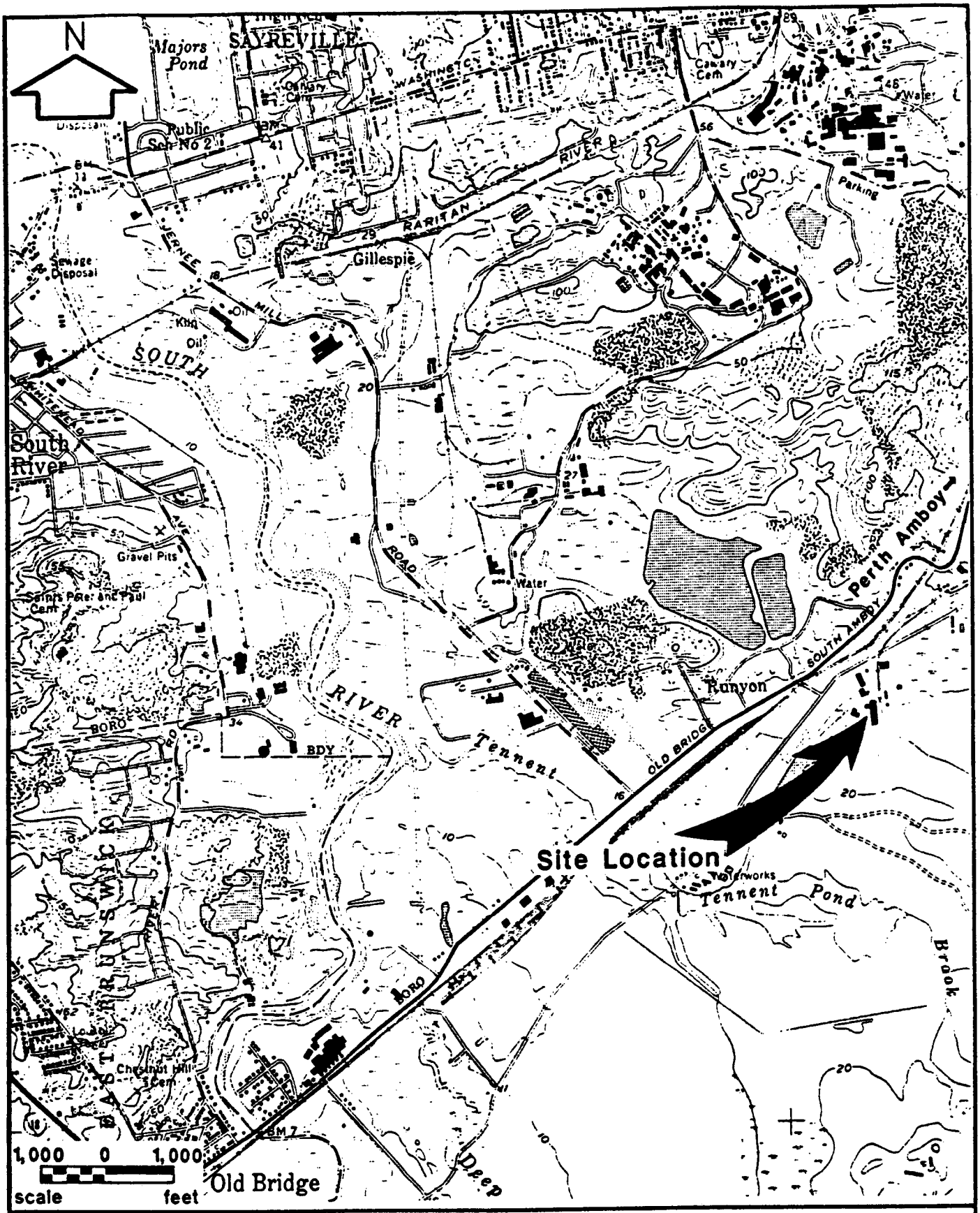

Figure 1

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Location Of CPS/Madison, Middlesex County New Jersey

CPS/Madison, Middlesex County, New Jersey

It ranges from 50 to 90 feet thick. The Woodbridge Clay is widespread throughout the Raritan Bay area.

The Sayreville Sand member is variable in composition but is typically a fine to medium grained white micaceous sand. In the vicinity of Runyon, adjacent to the site, it is reported to be absent.

The South Amboy Fire Clay overlying the Sayreville Sand is a white, light blue or red mottled clay which may contain dark lignitic beds. This unit is discontinuous in the area of CPS/Madison, with a variable thickness of up to 25 feet. This clay locally contains lenses of sand and thus there is possible hydraulic interaction between the Sayreville Sand and the Old Bridge Sand, which overlies the South Amboy Fire Clay.

The Old Bridge Sand is a fine to medium grained sand with clay lenses two to three inches thick and infrequent beds of clay of up to several feet thick. These clay beds are easily misinterpreted as South Amboy Fire Clay. The Old Bridge is the uppermost, unconfined aquifer underlying the CPS/Madison site. The depth to the first significant aquitard (the South Amboy Fire Clay, the Woodbridge Clay, or possibly clay beds within the Old Bridge) ranges from 50 to 100 feet and averages 75 feet.

The aquifer is heterogeneous according to well log and soil boring information, as well as pump test data which indicate variable transmissivity. According to Wehran's data, as presented by CH2M Hill (August 1984), transmissivities determined from semi-log plots range from 63,000 to 116,200 gallons per day per foot (gpd/ft). Storativities range from 0.035 to 0.10. In the CPS/Madison area, groundwater flows to the southwest at a rate of approximately 3 ft/day. Wehran reports a hydraulic gradient of .0059 and a hydraulic conductivity of 1150 gpd/ft^2 for the Old Bridge Sand.

1.3 HISTORICAL DEVELOPMENT

In the early 1970's, investigations by the NJDEP, Sayreville, and the City of Perth Amboy detected heavy metal pollutants in wells, surface water, and soils on and adjacent to the Pricketts Brook watershed property of Perth Amboy. This led to the shutdown of a portion of their potable water supply well system (Bennet Suction Line) in March 1971 and March 1973. Various studies have been conducted since 1971 by NJDEP and several outside consultants to investigate pollution of the Pricketts Brook watershed.

In February-April 1973, NJDEP conducted an investigation of the water quality of Pricketts Brook. Their report concluded that pollutants were entering the Perth Amboy wellfield by way of Pricketts Brook. NJDEP also concluded that the major source of metal pollution was from the Madison plant.

In March-April 1973, the Sayreville Water Department conducted an investigation to determine possible pollution of Sayreville's potable water supply by several facilities located in the watershed area including Madison, CPS, Jersey (Aluminum) Billets, and Middlesex Township Sewer Authority (MTSA). This study found cadmium, lead, and zinc in excess of potable water standards. A pond at Jersey (Aluminum) Billets was found to contain cadmium and lead in excess of potable water standards while effluent from Madison, containing heavy metals,

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was entering the Old Bridge Sand aquifer via a broken industrial sewer lateral connection to the MTSA.

In 1974-1975, Ad-Tek Engineering (Ad-Tek) conducted an investigation for the City of Perth Amboy to determine the extent of contamination of surface and groundwaters in the Pricketts Brook watershed. They found that Madison was not paved from 1967 to 1973 and the open storage of large quantities of raw material containing lead, zinc, and cadmium resulted in direct discharges to the groundwater from a broken sewer line. The sediments of Pricketts Brook and Pond were contaminated via runoff.

Madison had not complied with NJDEP's order to immediately cease all discharges into ground and surface waters from open storage and poor housekeeping. Since 1971, sampling of Pricketts Brook had consistently revealed increasing levels of heavy metals downstream of Madison.

In 1979 the New Jersey Superior Court issued a court order to investigate and determine the feasibility of the removal of contaminated groundwater and soil in the Pricketts Brook watershed. The Court requested the services of Dames & Moore, who reported their findings in an August 1980 report to the New Jersey Superior Court.

In addition to reviewing previous investigations and sampling groundwater, soil, sediment, and surface water, Dames and Moore proposed remedial schemes. A total of 75 schemes were considered which represented various combinations of decontamination and disposal options.

It was Dames & Moore's opinion that a slurry cut-off wall of over 5,000 feet, encompassing the CPS and Madison properties, would isolate the contaminated soil, one of the major contaminant sources. Both properties have since been paved and are now in compliance with State regulations, according to NJDEP, who has been monitoring the contamination and feels that the sources are now under control (personal comm., October 1988). This wall would key into the clay layer underlying the Old Bridge Sand creating a "bath-tub". Interior groundwater levels would be maintained by one system of wells while a second system of wells would operate outside of the wall, serving to decontaminate the aquifer between the proposed slurry wall and Pricketts Pond.

Treatment and disposal of the groundwater was to include heavy metals removal and sludge dewatering with discharge to the the Middlesex County Utility Authorities (MCUA) sewage treatment plant. In addition, Pricketts Brook would be rerouted south of the properties and Pricketts Pond would be dredged.

In October 1981 the Superior Court of New Jersey filed an Order mandating the implementation of a plan based on Dames & Moore's evaluation. The defendants, CPS and Madison, appealed this decision to the Appellate Court. The Appellate Court affirmed the judgment, modifying it in part and remanding it to the Trial Court for an amended judgment. The amended judgment was ordered in June 1983, after which the defendants sought unsuccessfully to take their case to New Jersey Supreme Court. Since NJDEP, at that time, was prohibited from hiring outside consultants, they attempted to design the court-ordered slurry wall themselves. Meanwhile, CPS and Madison retained their own consultants to explore remedial options.

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In 1982, Converse Consultants (Converse), on behalf of Madison, proposed an alternate containment and removal scheme. Based on their review of recent soil boring data, Converse concluded that the confining layer, proposed for use as the base of the "bath tub", is discontinuous. Therefore a program consisting of a partial slurry wall (i.e, not tied into an impervious base) in combination with pumping from the interior of the wall was suggested. The pumping would maintain negative heads inside the wall and flush contamination from the aquifer. This would be a more cost-effective remedy and would provide continuous flushing of the aquifer by groundwater flow beneath the wall from outside the affected area.

During this time the CPS/Madison site was reviewed under the Hazardous Ranking System (HRS) for inclusion on the National Priorities List (NPL). The site was listed in December 1982.

In May 1983, Wehran Engineering (Wehran) prepared a report on behalf of CPS, which evaluated conditions at the CPS/Madison site and determined whether a more cost-effective alternative existed than that mandated by the New Jersey Superior Court ~~for~~ and that proposed by Converse. Wehran found that the South Amboy Fire Clay was not continuous beneath the site thereby requiring the Woodbridge Clay to be used as an effective confining layer for the originally proposed perimeter cut-off wall. As a result of their findings, Wehran suggested a crescent shaped slurry cut-off wall downgradient of the recovery well and across the head of Pricketts Pond. The wall would key into a continuous clay strata and greatly reduce the pumping rate.

Wehran subsequently modified their program in June 1983 and March 1984 to perform additional computer modeling of various pumping scenarios at the request of NJDEP. The final proposed plan consisted of the crescent shaped cut-off wall and three wells pumping a total of 400 gpm and operating for 12 years to obtain four pore volume flushes of the aquifer.

In 1984, sampling programs for heavy metals and VOCs were conducted by Converse and Wehran, respectively, in order to determine the extent of sediment contamination in Pricketts Pond. They were also to evaluate whether it would be more cost effective to excavate the contaminated sediments, or flush out contamination by the proposed groundwater pumping decontamination program.

The results of these analyses found the degree and extent of contamination to be much less than that determined by Ad-Tek and Dames & Moore. Converse therefore found no reason to pursue dredging of the Pond or Brook and concluded that any residual and leachate heavy metal contamination would be removed by the aquifer decontamination program.

Wehran determined that the presence of VOC's in the sediment was due to the upward discharge of groundwater from the surrounding Old Bridge Sand aquifer. Wehran came to the same conclusions as Converse, that the proposed decontamination program would remove VOCs, and negate the need for dredging.

In June of 1983, NJDEP hired CH2M Hill to review the Court-ordered remedy of June 1983 which NJDEP had designed. CH2M Hill (August 1984) proposed the expansion of the slurry wall to the south and southwest to enclose the entire

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area of known contamination and eliminate the need for decontamination wells outside of the wall.

By Fall 1984, NJDEP had concluded that the alternative proposed by CPS and Madison, through Wehran and Converse, would be effective in remediating the groundwater pollution at the site. Negotiations for preparation of an agreement were finalized and presented to the Court for approval in September 1985.

This motion to amend the June 1983 judgment was opposed by the City of Perth Amboy, with one of the primary objections being that the plan would allow the defendant companies to under take the cleanup. This opposition was the subject of a hearing in January 1988 whereby the Superior Court of New Jersey found the measures mandated in the June 1983 judgment unsound. The Court approved NJDEP's motion to amend the judgment.

An Order was issued in April 1988 calling for the installation of the groundwater recovery system as proposed by Wehran (March 28, 1984), relocation of Pricketts Brook as proposed by Converse (May 27, 1988), and discharge of the recovered groundwater to the MCUA via the OBTSA system in accordance with all requirements of the MCUA and OBTSA and construction of a crescent shaped slurry cut-off wall.

1.4 NATURE AND EXTENT OF CONTAMINATION

A series of investigations into the nature and extent of contamination in the Pricketts Brook Watershed has been performed since the early 1970's. The following possible sources of contamination were identified upstream of the Runyon well field:

Food Additives, Inc. (Madison Industries)	- zinc compounds and heavy metals
CPS Chemical Co.	- Organic compounds, no heavy metals
North American Metals and Chemical Co.	- Incineration of photographic film, silver
Chemical Conversion Co.	- Hydrochloric acid, calcium chloride and byproducts
Aluminum Billets, Inc.	- Melting and extrusion of aluminum products
Manzo Contracting Co.	- Sand and gravel stock piling
Madison Township Sewer Authority	- 24 inch industrial sewer line along Waterworks Road and Pricketts Brook running through CPS and Food Additives

In addition, a closed dump at the intersection of Waterworks Road and Perrine Road may be a source of various pollutants. This dump is approximately 2 miles upstream of the Perth Amboy well field. There are also many instances of minor indiscriminant dumping along roads in the watershed.

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1.4.1 GROUNDWATER

In a letter dated May 8, 1970 to Perth Amboy, NJDEP expressed concern about the results of a routine analysis of water from Perth Amboy's well field. NJDEP noted zinc concentrations of 0.05 ppm and referred to the use of zinc by Madison. Results for wells sampled from December 1970 to September 1971 showed increasing concentrations of zinc until the Bennett suction line wells were shut down in March 1971, after which concentrations declined. Figure 2 shows the locations of wells in the CPS/Madison area.

VOCs

A plume of methylene chloride in the Old Bridge aquifer was found to extend south from the CPS property, through the Madison property toward Pricketts Pond. The highest reported concentration was 103 ppm at well B. this plume extends northwest of CPS, under the Madison property, and continues southwesterly along Pricketts Pond. This plume may extend as far as the Runyon pumping station where a concentration of 4.8 ppb was detected in Well C.

CPS was determined to be responsible for methylene chloride contamination due to the fact that one of their operations is the recovery of methylene chloride. During the time of the identification of contamination, CPS operated on unpaved ground. The CPS plant has since been concretized.

Variations in methylene chloride concentrations in groundwater with time at a given point did not indicate a common trend for all wells. Some wells (e.g. S-1, B and M-3) apparently exhibited wide variations, indicating a slug-type migration of methylene chloride. The two-year net change indicated some change in concentrations but are not adequate to draw conclusions on plume migration. Two additional isolated plumes (in addition to Well C near the Runyon pumping station) were also identified by Dames & Moore at Well S-3 and E. Concentrations of methylene chloride at these wells were 4 ppb and 17 ppb, respectively.

A plume of 1,1,2,2-tetrachoroethane was found to exist in roughly the same area as that of methylene chloride, extending south from CPS to Pricketts Pond. The highest concentration of this contaminant was also found in Well B at 8.4 ppm. The plume extends north and west of CPS to Pricketts Pond. Variations in concentration over time do not indicate any common trends for the wells. Although wide variations, indicative of slug type migration were exhibited at some wells (M-3 and B), while well S-1 remained relatively stable (8.00 to 8.43 ppm).

An additional 20 organic compounds were detected in relatively high concentrations in the groundwater by either Dames & Moore or prior studies. The mean highest detected concentration at the wells for individual contaminants ranged from 0.004 to 9.2 ppm.

In their 1983 report, Wehran plotted total VOC concentrations in the CPS/Madison area based on NJDEP data from 1982. Their plume is shown in Figure 3.

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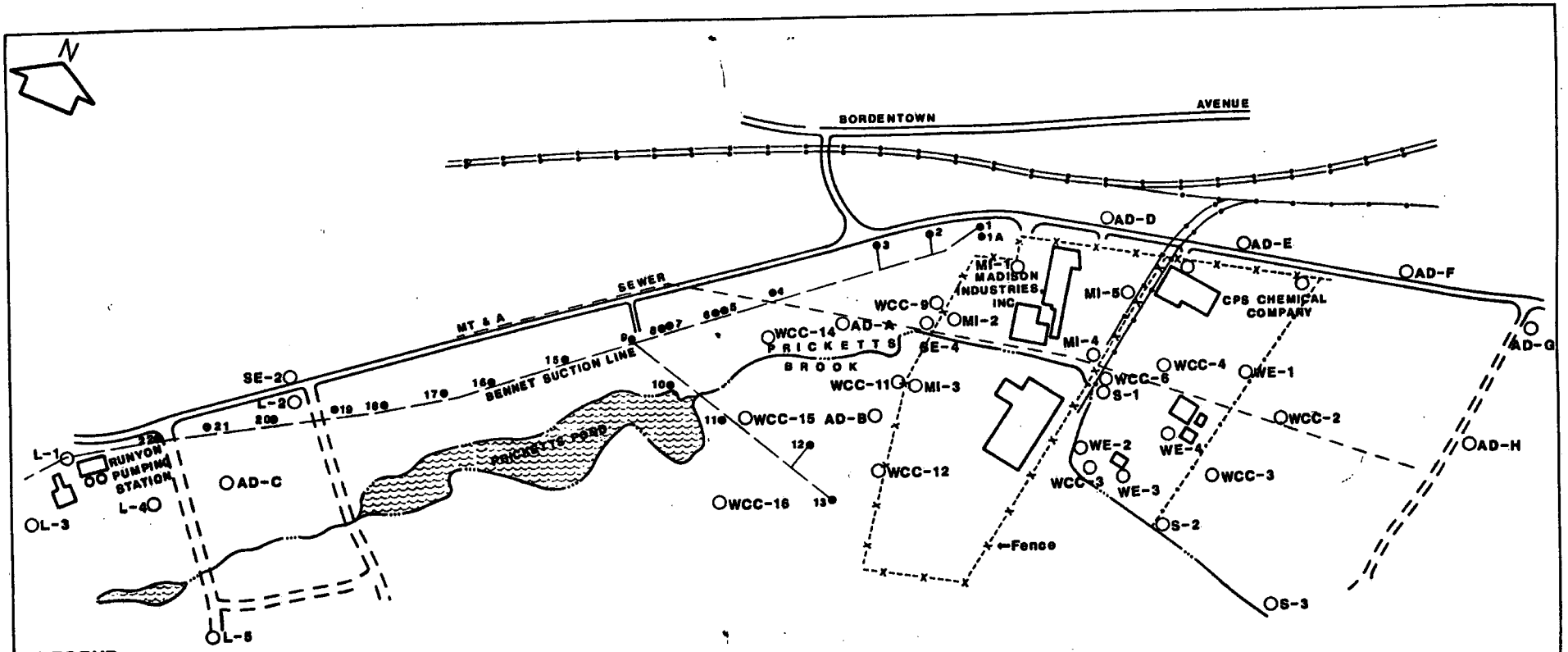

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Figure 2

Location Of Groundwater Wells In The Pricketts Brook Watershed

CPS/ Madison, Middlesex County, New Jersey

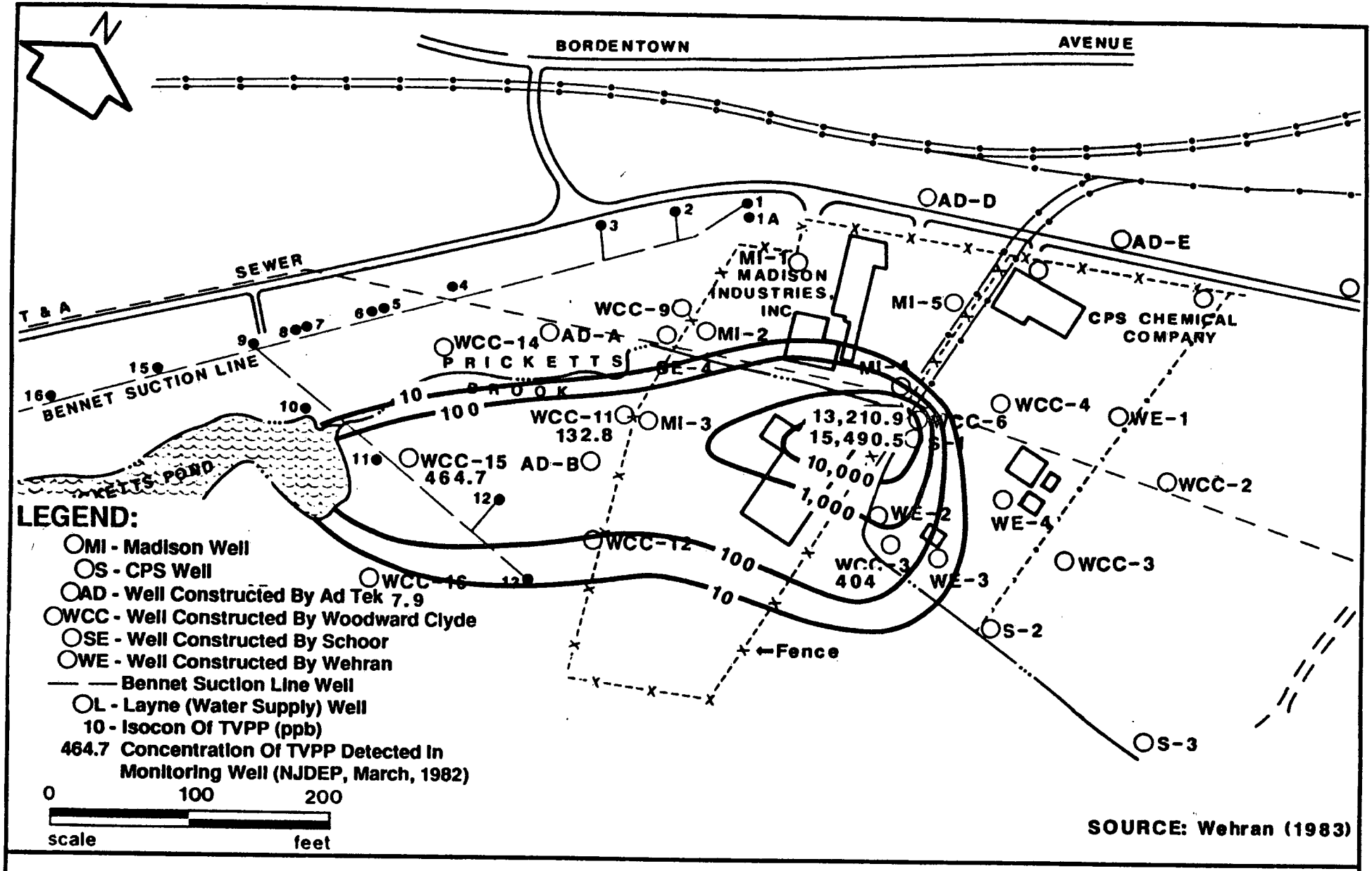

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Figure 3

Extent Of VOC Contamination In Groundwater

CPS/ Madison, Middlesex County, New Jersey

Metals

In 1975 Ad-Tek installed seven observation wells (identified as A, B, D, E, F, G and H) north, east and west of CPS/Madison and collected samples from five existing Perth Amboy wells (wells 1, 3, 4, 11 and 13). Samples taken from wells upgradient of the CPS/Madison complex (wells E, F, G and H) revealed no detectable concentrations of lead, cadmium or zinc at depths of 10', 20', and the bottom of the wells (up to 50'). Samples taken from existing water supply wells at 10', 20', and the bottom of the wells (up to 42') at or dwongradient from the Madison plant showed concentrations of zinc of up to 8 mg/L with heaviest concentrations at wells A and D, west and southwest of Madison. Wells south of Pricketts Brook showed no heavy metal contamination. Since CPS utilizes only organic chemicals, Madison remained the only major source of heavy metal contamination.

Ad-Tek suspected that a heavily polluted zone existed downgradient from the Madison plant (built in 1967) as a result of direct infiltration of heavy metals prior to pavement of the plant operations area in 1973. The broken sewer lateral was also suspected to contribute to the contamination of the groundwater.

In 1979-1980 Dames & Moore sampled eight existing monitoring wells (A, B, D, E, S-1, M-1, M-2 and M-3). Dames & Moore detected strong odors from wells B, M-3 and S-1 within a few minutes of redevelopment. Each well was sampled for analysis of zinc, lead, cadmium, methylene chloride and 1,1,2,2-tetrachloroethane. These compounds were selected based on available information suggesting that these constituents were major contaminants of the Old Bridge aquifer.

Dames & Moore determined the extent of ~~the groundwater plumes of the~~ five selected contaminants in groundwater where concentrations were above Federal and State drinking water standards (5 ppm for zinc, 0.05 ppm for lead, 0.01 ppm for cadmium; not yet established for methylene chloride or 1,1,2,2-tetrachloroethane).

The central portion of the zinc plume was located within the Madison property with the highest concentration in groundwater of 3,570 ppm at well M-2. At the fringes of the plume beyond property boundaries, concentrations were on the order of one hundred times less. The two-year net change in concentration, based on 1979 sampling by Dames & Moore and 1977 sampling by others, showed some change in zinc concentration. Some wells exhibited relatively wide variations (M-1, M-2) indicating a slug type migration of zinc, while other wells (D) showed only slight variations over time. However, one round of sampling is not sufficient to draw definite conclusions on movement of the zinc plume.

In addition to the primary plume described above, two smaller plumes were identified: in the vicinity of well F with groundwater zinc concentrations of 2.6 ppm and in the vicinity of Layne well 4 with a maximum concentration of 15 ppm.

In their 1983 report, Wehran plotted concentrations of zinc in the CPS/Madison area based on NJDEP data from 1982. Their zinc plume is shown in Figure 4.

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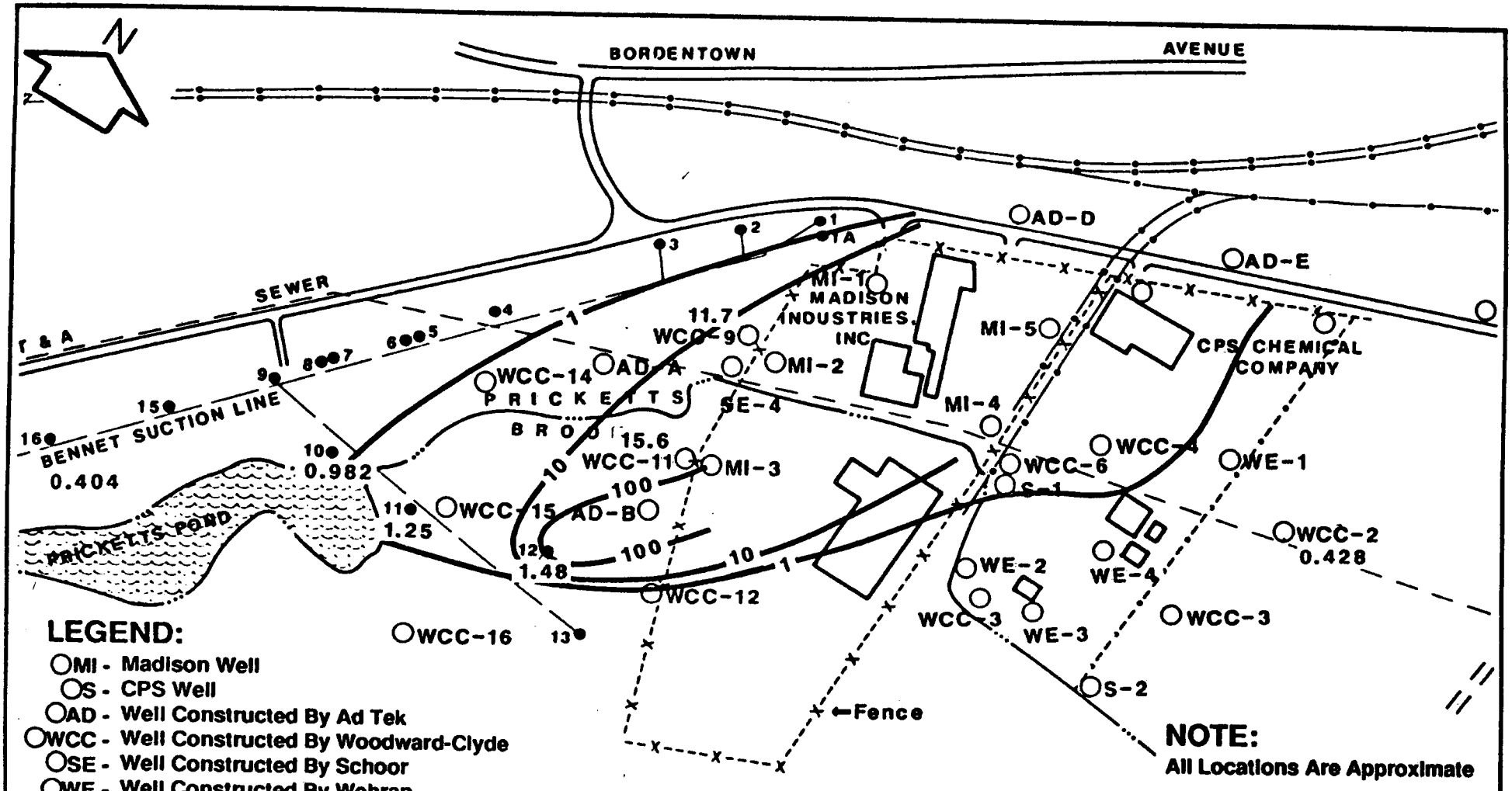

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Figure 4

Extent Of Zinc Contamination In Groundwater

CPS/ Madison, Middlesex County, New Jersey

Lead is present in the vicinity of both CPS and Madison. The maximum concentration found in the groundwater was 0.8 ppm at well M-1. As with zinc, variations in concentration overtime do not indicate a common trend for all wells. The two-year net change in lead concentrations showed increases in wells M-2, M-3, S-1 and E and decreases in wells M-1, A, B and D. Again, a single sampling round is not sufficient to draw conclusions regarding migration of lead in the groundwater. A second plume of lead in the groundwater was found in the vicinity of wells C and Schoor well 2 with concentrations of 0.117 and 0.644 ppm respectively.

Dames & Moore determined that cadmium was present in the groundwater in the vicinity of CPS and Madison with the central portion of the plume situated under and to the immediate west of Madison. The highest concentration detected in groundwater was 1.7 ppm at well M-1.

Variations in cadmium concentration over time for a given sampling point indicated a trend more common to all wells than that seen for zinc and lead. Based on the two-year net change, it appeared that the concentration of cadmium in groundwater decreased, but again this is based on one round of sampling. A second, smaller area of cadmium contamination in groundwater was found in the vicinity of Bennett suction line well 16 with a concentration of 0.021 ppm.

1.4.2 SOIL

In their investigation in 1975 Ad-Tek collected split spoon samples from wells A, D and F. Wells A and D, located to the south and northwest of the CPS/Madison complex and at a depth of 40 to 42 feet, exhibited lead and zinc concentrations almost 2 and 4 times higher, respectively, than concentrations found in well F, located further to the north, at a depth of 35 to 37 feet.

Dames & Moore, in their 1979-1980 investigation collected soil samples at a majority of the wells where they had collected groundwater samples. Samples results were evaluated for zinc, lead, and cadmium only, since no previous data was available on organic contamination. Dames & Moore assumed that plume configurations for soil contamination would be the same as that for groundwater.

Zinc

The zinc plume, centralized under the Madison property, had a high concentration of 14,250 ppm at well M-2. In wells M-1, M-4 and M-5, the highest zinc concentrations (from 1.1 to 14,250 ppm) are limited to the upper 10 feet of soil; from 10 to 45 feet, zinc concentrations do not exceed 150 ppm. These three wells are located on the northern and northeastern property boundary. In wells M-2, and M-3, along the southwestern property boundary zinc concentrations to a depth of 45 feet vary only slightly from 180 ppm in M-2 and 80 ppm in M-3. This would indicate that the area in the vicinity of wells M-1, M-4 and M-5 may be where zinc was introduced to the soil.

Two secondary, smaller zinc plumes were identified with zinc concentrations in the soil of 10 ppm at well F and 32.2 ppm at Schoor 3.

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Lead

The area of heaviest lead contamination identified by Dames & Moore, to the west of Madison, is characterized by concentrations in the soil of up to 414.66 ppm (well M-4). The eastern portion of the plume, to the east of CPS, was characterized by lead concentrations of greater than 100 ppm in the upper 4 feet of wells M-1 and M-4. Below this depth values do not exceed 11 ppm (well M-4). Samples from well M-2, M-3 and M-5 revealed concentrations to a depth of 45 feet which remained less than 16 ppm in wells M-2 and M-3 and 9 ppm in well M-5.

Cadmium

The central portion of the cadmium plume determined by Dames & Moore, to the west of Madison, exhibited a maximum cadmium concentration of 18.13 ppm in well M-3. Unlike zinc and lead, variations in cadmium concentrations with depth in wells M-1 through M-5 are not limited to the upper few feet of soil, but were found to be more or less evenly distributed throughout. In addition to this plume a small secondary plume was found at Schoor well 2 with a cadmium concentration of 0.024 ppm in the soil.

1.4.3 SURFACE WATER AND SEDIMENT

Early sampling investigations of the surface waters and sediments of Pricketts Brook and Pond were conducted by NJDEP and in conjunction with the Ad-Tek report. Pricketts Brook originates in a marshy area approximately 1,000 feet northeast of CPS. The brook flows through the CPS/Madison site and continues for approximately 700 feet to Pricketts Pond. The segment of the brook downgradient from Madison has been referred to as an eroding stream bed (i.e., suspended material would not tend to deposit on the stream bed). Thus, such material is transported directly to Pricketts Pond which acts as a sink.

Metals

The NJDEP investigation conducted during early 1973 included surface water and sediment sampling. Only aluminum and cadmium were found at high levels (4 ppm and 0.05 ppm respectively) immediately upgradient of CPS. The increase in aluminum in this portion of the brook was confirmed to be caused by the Aluminum Billets settling pond. No significant increase of contaminant concentration was found as the stream flowed through CPS.

However, samples immediately downgradient from Madison revealed a significant increase in iron, lead, and zinc (a 6.6 to 9.7-fold increase). Another marked increase in concentrations of lead and zinc were noted further downstream. NJDEP suspected this was caused by wastewater from the broken sewer lateral entering the groundwater and discharging to the brook in these areas.

In conjunction with the Ad-Tek report, sediment sampling and analysis was conducted along Pricketts Brook and in Pricketts Pond. Three grab samples were collected from the bottom of the pond and one composite sample was collected from 15 points along the shore at the upper end of the pond. The three bottom sediment samples yielded zinc concentrations of 1730 to 12,250 ppm, lead concentrations of 400 ppm and levels of cadmium at or below the 10

ppm detection limit. The composite sample yielded a zinc concentration of 3,555 ppm, a lead concentration of 600 ppm and, again, trace levels of cadmium.

It was concluded that this contamination must come from Pricketts Brook and not the groundwater since the pond serves as recharge to the surrounding wells.

Composite samples were also taken from the top 0.5 inch of sediment at four sampling points along Pricketts Brook. The samples just downgradient from the Madison property had zinc and lead concentrations of 1360 and 330 ppm, respectively, while further downstream concentrations were 650 and 300 ppm, respectively, with only trace levels of cadmium at both stations. The composite from the inlet to Pricketts Pond had concentrations of zinc and lead at 3750 ppm and 700 ppm, respectively, and trace levels of cadmium. These results are in contrast to those for a station upstream of the CPS/Madison complex with zinc concentration of 80 ppm, lead not detected and trace levels of cadmium.

In their 1979-1980 investigation, Dames & Moore collected one surface water sample from Pricketts Brook, near its entry to Pricketts Pond. Sample analysis revealed the presence of 31 ppm zinc, 0.04 ppm lead, 0.01 ppm cadmium, 125 ppb methylene chloride and 83 ppm 1,1,2,2-tetrachloroethane.

Dames & Moore also took four sediment samples from Pricketts Pond. Two samples were collected at the upper end of the pond near the entry of Pricketts Brook, one sample was taken from the middle of the pond, and one from the downstream end of the pond.

On behalf of Madison, Converse (May 1984) investigated the extent of heavy metal contamination of the sediments of Pricketts Pond and evaluated whether it would be more cost effective to excavate the contaminated sediments or flush out the sediment by their proposed aquifer decontamination plan.

Sediment was sampled with a Shelby tube at 15 locations within the pond; five downstream from the proposed slurry wall and 10 upstream. An additional 3 locations were sampled between the pond and Madison and 2 locations were sampled upstream of the CPS/Madison site. Alternate six inch increments were analyzed by the EP Toxicity test for cadmium, lead, zinc, and copper. A total of 90 samples were analyzed.

Zinc was found at or above the detection limit of 0.01 mg/L in all 90 samples with a maximum concentration of 41 mg/L. Copper was found at or above the detection limit of 0.05 mg/L in 28 of the samples with a maximum of 0.42 mg/L, and lead was found in only two samples at or above the 0.05 mg/L detection limit with the maximum concentration of 0.06 mg/L. All of the maximum concentration samples were found in the upstream end of the pond. All concentrations were also well below the toxic threshold concentrations set at 100 times the National Interim Primary Drinking Water Standards or Secondary Drinking Water Regulations, as applicable.

Converse concluded that low grade contamination could be found in the upper 1 to 2 feet of sediment and as suggested by Wehran, a significant portion of the contamination may be due to the contaminated groundwater. Converse also

concluded that there was no reason to further consider dredging the pond or brook and that any residual, leachate contamination would be removed by the proposed decontamination program.

VOCs

In March 1984, Wehran collected 89 sediment samples at 21 stations using brass shelby tubes. Fifteen of these stations were within Pricketts Pond, four stations were along Pricketts Brook between the pond and Madison, and two stations were upstream of the CPS/Madison complex. Each sample was analyzed for 33 volatile compounds; only 11 were detected in any of the 89 samples above the respective detection limit.

Methylene chloride was the most prevalent VOC, occurring in 46 samples. The remainder of the parameters occurred in a range of five to 19 samples. The total VOCs were predominantly found in the upper six and possibly 12 inches of sediment (Figure 5). In addition, the highest total VOCs were found in the upstream end of the pond. The highest concentration observed was for methylene chloride at 2.35 ppm. In addition, no sample contained a total VOC concentration exceeding 10 ppm; the highest observed was 2.74 ppm.

The contamination may have been introduced to the pond by inflow from Pricketts Brook and subsequent sedimentation or discharge to contaminated groundwater. Wehran believes the distribution of total VOCs (with respect to depth and area within the pond) suggests that groundwater discharge may be the major mechanism accounting for their presence. Deeper sediment samples with total VOC levels of up to 1,433 ppb and averaging 179 ppb may be more representative of the plume of groundwater contamination and its discharge. Also the highest levels are not associated with the deltaic sediments at the head of the pond where Pricketts Brook converges.

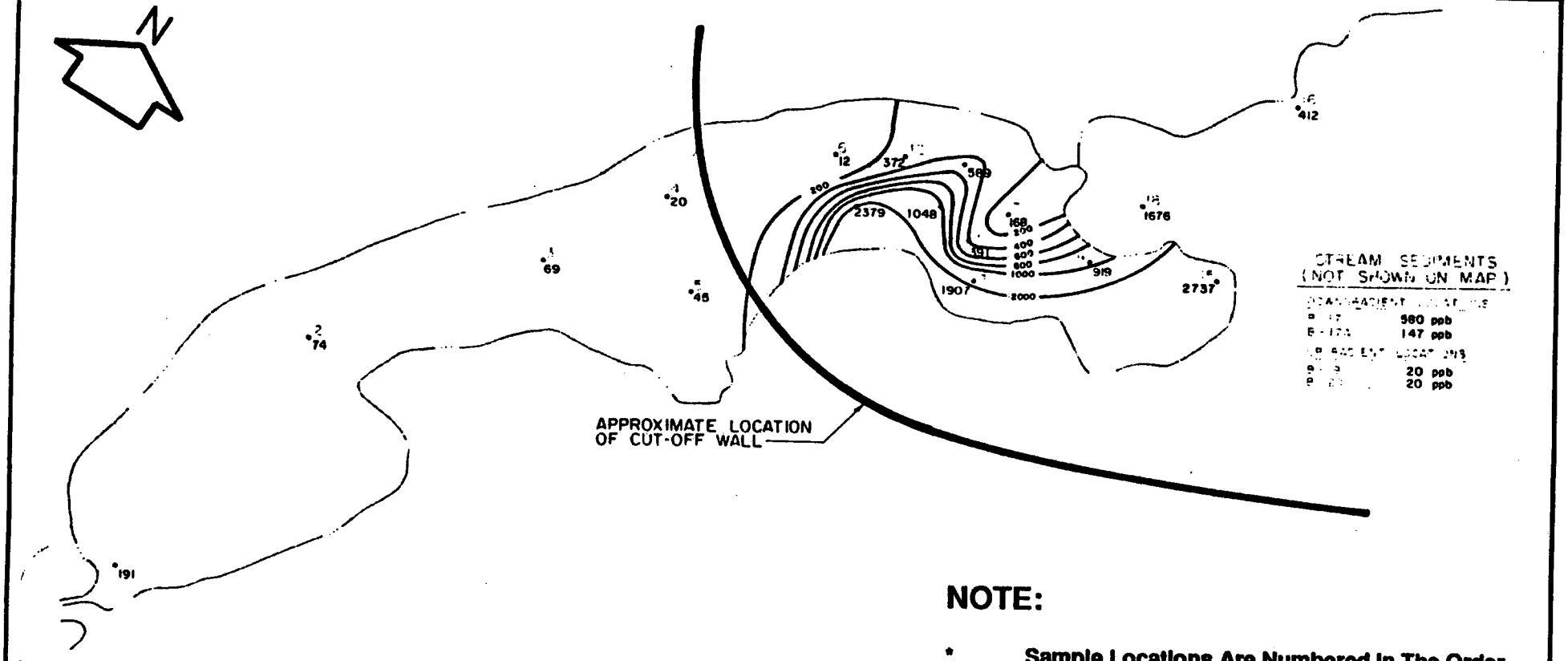
Comment. Wehran concluded that neither the concentration nor total mass of VOCs in the sediments warranted dredging, and that their proposed remedial plan would recover the contaminants. This idea concurs with SARA (Section 121), which discourages the off-site transport and disposal of hazardous substances without treatment.

2.0 TECHNICAL AND REGULATORY REVIEW

2.1 THE RI/FS PROCESS

The purpose of this section is to identify data gaps which must be filled in order to comply with EPA's Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA (OSWER Directive 9335.3-01, Draft, March 1988).

The RI/FS process unofficially began with preliminary site investigations in the early 1970's, conducted predominantly by NJDEP. An initial RI/FS report was completed in August of 1980 by Dames & Moore, prior to the site's placement on the NPL.



LEGEND:

- Limits Of Prickett's Pond As Taken From Map Supplied By Converse Consultants
- 3 * Number And Approximate Location Of Sample
- 69 ** (Total Volatile Organic Concentration In ppb)
- 400 Total Volatile Organic Concentration Contour

NOTE:

* Sample Locations Are Numbered In The Order They Were Collected.

** Sum Of Volatile Organic Results From Individual Parameters Including "Less Than" Values As The Dectection Limit.

SOURCE: Wehran (April, 1984)

0 100 200

scale feet

CDM - Federal Programs Corporation

environmental engineers, scientists
planners & management consultants

Figure 5

Total Concentration Of Volatile Organics In The 0"-6" Interval

CPS/ Madison, Middlesex County, New Jersey

Subsequent investigations were conducted when the State questioned the continuity of the South Amboy Fire Clay, a requirement of the "bath-tub" plan designed by Dames & Moore and ordered by the Court in 1981. These investigations serve as evaluations of the remedial plan and attempted to improve on the effectiveness and implementability of the original plan. Sections 2.1.1 and 2.1.2 of this report deal mainly with the 1980 Dames & Moore investigation. The major points of the subsequent investigations as they refer to the RI/FS process are described in Sections 2.1.3 through 2.1.6 of this report.

2.1.1 SCOPING

Scoping is the initial planning phase of the RI/FS process. Typical scoping activities include 1) collecting previous information, 2) developing a site management strategy, 3) identifying and discussing potential ARARs with lead and support agencies, 4) identifying data needed, 5) developing data quality objectives, 6) assembling a technical advisory committee, and 7) preparing a Work Plan (WP), a Sampling and Analysis Plan (SAP) which includes a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP), a Health and Safety Plan (HSP), and a Community Relations Plan (CRP).

Dames & Moore's scoping phase was summarized in a letter of September 18, 1979 to Judge Furman describing their scope of work as consisting of but not limited to the following basic elements:

1) gathering of historical data;

2) field investigations;

3) installation of test/monitoring wells, sampling and chemical analyses to fill-in-data gaps and update existing water quality information as needed;

4) construction of overlay maps depicting the shape of levels of concentration of various contaminant plumes; and

5) if feasible, development of a method or methods to either mitigate or eliminate the contaminants.

Comment. Although this letter appears to have generally satisfied the requirements of the scoping phase, there is no indication that potential ARARs were discussed with lead or support agencies at this early stage. In addition, there is no indication that the deliverables required by EPA (WP, SAP, HSP, and CRP) were prepared by Dames & Moore or any subsequent investigators. Specifically with regard to SARA, the CRP is of utmost importance. Section 117 of CERCLA emphasizes the importance of early, constant, and responsive relations with affect communities. According to NJDEP (personal comm., October 1988), a CRP has been planned and will be implemented when the design is refined.

2.1.2 SITE CHARACTERIZATION

The major components of the site characterization phase include 1) conducting field investigations, 2) analyzing field samples in the laboratory, 3) evaluating results of data analysis to characterize the site and develop a baseline risk assessment, and 4) determining if data are sufficient for developing and evaluating potential remedial alternatives.

Field Investigation

Field Activities. Dames & Moore selected eight monitoring wells for resampling, based on previous results indicating that these wells contained the highest concentrations of contaminants. One surface water sample was collected from Pricketts Brook about 30 feet upstream from where the brook enters Pricketts Pond. Dames & Moore collected a total of four sediment samples from Pricketts Pond. Two sediment samples were sent for appropriate testing and analysis to determine acceptability of the sediments for treatment and disposal. All samples collected by Dames & Moore were analyzed for the following five constituents:

- zinc
- lead
- cadmium
- methylene chloride, and
- 1,1,2,2-tetrachloroethane

The selection of these contaminants was based on previous reports that these constituents played a major role in contaminating the Old Bridge Sand aquifer. All five constituents were detected in groundwater and zinc, lead, and cadmium were detected in soil. Previous investigations, however, detected 32 other organic compounds in groundwater. Dames & Moore tabulated their results and the results of previous investigations for 33 wells in the area.

Site Physical Characteristics. Physical characteristics of a site must be collected to define potential transport pathways and receptor populations and to provide engineering data for development and screening of alternatives. EPA guidance suggests that information on the following subjects is needed: surface features, geology, soils, surface water, hydrology, hydrogeology, meteorology, human populations, and ecology.

In Dames & Moore's assessment of the general hydrogeologic conditions of the site, they indicate a possible hydraulic connection between the two major aquifers, the shallow Old Bridge Sand and the deep Farrington Sand. The connection may be due to "discontinuities" in the clay members, filled with sandy soil with high vertical permeability, and a downward vertical gradient between the two aquifers.

Average velocities of groundwater flow in the Old Bridge Sand were estimated by Dames & Moore as 3.0 ft/day within CPS property, and 3.7 ft/day within Madison Industries property. Travel time of a portion of groundwater from the eastern boundary of CPS property to Pricketts Pond was estimated at two years, and from the eastern boundary of Madison Industries

property to Pricketts Pond one year.

Nature and Extent of Contamination. EPA guidance requires that the extent of contamination be documented using an analytical level which yields data quality that is sufficient for a risk assessment and for subsequent analysis and selection of remedial alternatives. At hazardous waste sites, the nature and extent of contamination is of concern in five media: groundwater, soil, surface water, sediments, and air.

While the southern, eastern, and western horizontal extent of contamination was defined adequately for the 5 contaminants, there is no indication in the project files that the northern extent was defined. The borders for the investigations appear to be the Penn Central railroad. On October 14, 1988 CDM FPC contacted NJDEP to inquire about the northern extent of contamination. The State indicated that wells to the north of the site were sampled and found to be clean.

ARARs used by Dames & Moore were EPA and New Jersey State drinking water standards for metals (zinc, lead, and cadmium) and TCE (since established levels for methylene chloride and 1,1,2,2-tetrachloroethane were not available at the time of their investigation).

Laboratory Analyses

Federal or State lead site investigations have the option of using mobile labs, the CLP, or a non-CLP laboratory that meets the data quality objectives of the site investigation. Because the samples were collected and analyzed prior to implementation of the CLP, Dames & Moore did not use CLP-approved labs. Although Dames & Moore did not specifically state their DQOs, they were given the general task to investigate and report "on the feasibility and advisability of containment and removal of contaminated groundwater and soils in the Pricketts Brook watershed..." The data that they collect must support their remedial design.

Data Analysis

According to EPA guidance, the presentation of data in the RI can be divided into an analysis of site characteristics (physical, source, nature and extent, and contaminant fate and transport) and a baseline risk assessment.

Dames & Moore's analysis of physical characteristics appears adequate. Their analysis of source characteristics is general, implicating CPS and Madison Industries. However, specific source locations and the type and integrity of waste containment was not described in Dames & Moore's report. According to NJDEP (personal comm., October 1988), both facilities were unpaved during the time of release. Madison was paved in 1973 and CPS was paved in 1978. There was no excavation of contaminated soil prior to pavement. However, the State feels that the source has been controlled, since their monitoring program indicates declining levels of contamination. The mobility and persistence of source contaminants should also be evaluated.

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Dames & Moore reported on the mobility and adsorption of zinc, lead, and cadmium and found zinc and cadmium to be generally more mobile that lead. For organics, their limited report states that "sandy, silty, and clayey soils do adsorb organics." This includes 32 organic compounds (in addition to methylene chloride and 1,1,2,2 - tetrachloroethane) found in groundwater in the Old Bridge Sand aquifer and suspected by Dames & Moore to be contaminating the soil of the Old Bridge Sand Dames & Moore have adquately evaluated the nature and extent of contamination for the following contaminants: zinc, lead, cadmium, methylene chloride, and 1,1,2,2-tetrachloroethane. In an effort to describe the nature and extent of contamination from other organic compounds detected during previous investigations, Dames & Moore concluded the following:

- there is not enough data on the aerial distribution of most of these compounds to permit a proper evaluation of the presence and significance of some of these and possibly other (supplemental) organic compounds in the Old Bridge Sand aquifer. A special, more detailed, investigation and analysis would be necessary prior to the start of the clean-up operation to provide a basis for incorporating, if necessary, these organic compounds into the clean-up program.

- the aerial configuration and the depth of the "plume" of each of these organic compounds in the Old Bridge Sand aquifer is similar to that which were distinquished for methylene chloride and 1,1,2,2-tetrachloroethane.

In terms of contaminant fate and transport, Dames & Moore did not use analytical or numerical modeling as is suggested by EPA guidance. Instead, Dames & Moore compared their results for the 5 main contaminants of concern (zinc, lead, cadmium, methylene chloride, and 1,1,2,2-tetrachloroethane) with the results from previous investigations in 1977. Their general conclusion was that "one round of sampling was not sufficient to draw definitive conclusions regarding ....movement of the.... plume over the past two years". Additional periodic sampling is necessary to assess the problem.

Data Management Procedures

A document inventory and filing system must be developed in order to comply with EPA guidance. An outline for a suggested file structure for Superfund sites can be found in Table 3-11 of EPA Guidance on Conducting Remedial Investigations and Feasibility Studies Under CERCLA (March 1988 DRAFT). A report by CH2MHill (August 1984) provides an inventory of documents relating to the CPS/Madison site and satisfies some of the requirements for data management.

Reporting During Site Characterization

EPA guidance requires that a draft RI report be submitted to ATSDR for its use in preparing a health assessment. On September 8, 1988 Denise Johnson

of the ATSDR contacted Paul Harvey of NJDEP in order to obtain information about CPS/Madison to be used for a health assessment.

Summary of Comments by CDM FPC

Comment. Dames & Moore did not comment on other physical characteristics of the site such as surface features, meteorology, human populations, and ecology, nor did other more recent reports.

Comment. As pointed out by Geraghty & Miller (November 6, 1986), the current state of contamination (horizontal and vertical) must be determined before any remedial plan is implemented, due to the mobility of the contamination. The 1984 remedial plan by Wehran, for example, is based on data collected in 1982.

Comment. Thus far (according to Paul Harvey of NJDEP, October 28, 1988), the only data which has been validated was the NJDEP data from 1982. This data was vaidated to the State's Tier 2 level. This level is one level below the Enforcement Quality level, which is equivalent to EPA's CLP data. According to NJDEP (October 28, 1988), the final round of samples are to be analyzed for VOCs and heavy metals, but not the TCL. Before the design is implemented, a final round of samples should be analyzed for the TCL contaminants.

Comment. The reports reviewed by CDM FPC do not indicate why CPS is responsible for methylene chloride, which is often a laboratory contaminant introduced during analysis of samples. It should be noted that the CPS plant is involved in methylene chloride recovery.

Comment. A baseline risk assessment was not performed in accordance with the Superfund Public Health Evaluation Manual (SPHEM) (EPA/540/1-861060, OSWER Directive 9285.4-1, October 1986), as EPA guidance suggests.

Comment. All data collected thus far should be tabulated in order to aid the decisionmaker in refining the design of the remedial action. As new data is collected, the table should be updated.

Comment. A health assessment must be completed by ATSDR.

2.1.3 DEVELOPMENT OF ALTERNATIVES

The development of alternatives is the initial phase of the FS process. This phase is followed by the screening of alternatives and the detailed analysis of alternatives. The alternative development phase consists of six general steps, as follows:

- development of remedial action objectives based on contaminant-specific ARARS and risk-related factors.
- development of general response actions for each medium of interest.

- identification of volumes or areas of media to which general response actions might be applied.

- identification of and screening of technologies applicable to each general response action.

- identification of and evaluation of technology process options.

- assembly of alternatives to represent a range of treatment and containment combinations.

EPA guidance suggests the following types of source control action alternatives:

- A number of treatment alternatives ranging from one that would eliminate the need for long-term management (including monitoring) at a site to one that would use treatment as a primary component of an alternative to address the principal threats at the site.

- One or more alternatives that involve containment of waste with little or no treatment but protect human health and the environment by preventing exposure and/or by reducing the mobility.

- A no-action alternative.

For groundwater response actions, alternatives should address not only cleanup levels but also the time frame within which the alternatives might be achieved.

A total of 75 different remedial schemes were considered by Dames & Moore in terms of cost and technical accuracy. Most of the schemes represent various combinations of the following decontamination and disposal measures:

- pumping the aquifer by means of decontamination wells (three pumping rates considered were 700 gpm, 2100 gpm and 5000 gpm.);

- partial containment of a contaminated portion of the aquifer by means of a slurry cutoff wall (two options, a wall 70 feet and one 120 feet deep);

- removal of heavy metals from groundwater and sludge dewatering in a treatment plant;

- removal of hydrocarbons from groundwater via air-stripping, by means of a cooling tower, aeration lagoon and spray irrigation;

- reduction of the organic content in the extracted water to a level compatible with environmental requirements by means of filtration and carbon adsorption;

- five options for discharging treated water;

  - o discharge to the Old Bridge Township Sewer
  - o discharge by force main to MCSA interceptor
  - o discharge by gravity sewer to MCSA interceptor
  - o discharge to the aquifer via spray irrigation
  - o discharge by gravity to a surface water body

- removal of sediments from Pricketts Pons and Pricketts Brook by means of dredging with disposal of solids in the ocean;

- same, with disposal on land;

- rerouting Pricketts Brook south of the CPS and Madison Industries properties with;

  - o a lined new channel,
  - o an unlined new channel;

- demolishing the plants (CPS and Madison Industries, Inc.); and

- no-action.

Dames & Moore developed remedial alternatives based on only 5 of the 37 contaminants found in groundwater of the Old Bridge Sand aquifer. In addition, the "bath-tub" plan was selected as a possible alternative without verifying the continuity of a confining layer. Clearly, more information should have been obtained by the Court before their 1981 Order was issued.

In order to satisfy EPA requirements, any further development of alternatives must specify remedial action objectives. Acceptable exposure levels for human health should be determined on the basis of the risk factors and contaminant-specific ARARs identified during the site characterization. Contaminant levels in each media should be compared with these acceptable levels. Acceptable exposure levels should be determined on the basis of an evaluation of the following factors:

- for carcinogens, whether the chemical-specific ARAR provides protection within the risk range of 10^{-4} to 10^{-7} and whether achievement of each chemical-specific ARAR will sufficiently reduce the total risk from exposure to multiple chemicals

- for non-carcinogens, whether the chemicals-specific ARAR is sufficiently protective if multiple chemicals are present at the site

- whether environmental effects (in addition to human health effects) are adequately addressed by the ARARs

- whether the ARARs adequately address all significant pathways of human exposure identified in the baseline risk assessment.

If an ARAR is determined to be protective, it should be used to establish the acceptable exposure level. If an ARAR is not protective (i.e., presents a risk greater that 10^{-4}), does not exist for the specific chemical or pathways of concern, or multiple contaminants may be posing a cumulative risk, acceptable exposure levels should be identified through the risk assessment process.

2.1.4 SCREENING OF ALTERNATIVES

Screening is the second phase of the FS process and is used as a tool throughout the alternative development process to narrow the universe of options being considered.

Dames & Moore screened the alternatives developed during their investigation and concluded the following:

- Of three pumping rate options (700 gpm, 2100 gpm, and 5000 gpm), a rate of 2100 gpm will lead to a much shorter average duration of pumping compared to a 700 gpm rate and to a somewhat more realistic duration of pumping compared to a 5000 gpm pumping rate. The following table illustrates this:

Pumping rate, gpm	Duration of Pumping, Years	
	Without Slurry Wall	With Slurry Wall
700	10	3.6
2,100	3	1.2
5,000	1.5	0.5

- Of two options pertaining to the depths of the slurry wall (70 or 120 feet), preference is given to 70 feet (the condition being that the South Amboy Fire Clay layer underlying the contaminated Old Bridge Sand aquifer, is continuous within the perimeter of the slurry wall. This would have to be determined by a comprehensive subsurface investigation and detailed geologic analysis).

- The options proposed for water treatment and disposal should be analyzed in detail.

- A pilot scale investigation should be conducted to determine actual parameters for operation of the alternative treatment schemes so that empirical numbers could be given to regulatory agencies for their formal consideration.

Additional remedial measures recommended by Dames & Moore consist of a) removal of sediments from Pricketts Pond and disposal on land, b) removal of contaminants from Pricketts Pond water after dredging, and c) rerouting Prickets Brook in an unlined channel.

2.1.5 TREATABILITY INVESTIGATIONS

Treatability studies are conducted to allow treatment alternatives to be fully developed and evaluated during the detailed analysis, to establish

design criteria, and to reduce cost and performance uncertainties.

For the CPS Madison site, a treatability study was conducted by Princeton Aqua Science (PAS) in 1983, on the suggestion of Dames & Moore. The study's primary objectives were:

- Characterize the contaminated groundwater
- Determine the inhibitory affects of the contaminated groundwater on the aerobic treatment system in existence at the MCUA.
- Determine the impacts of the treated groundwater on the contents of the sludge produced in the aerobic digestion system at the MCUA.
- Assess the need to pretreat contaminated groundwater from the CPS Madison site prior to entrance into the MCUA.

CDM FPC did not review the Draft Report submitted by PAS in March of 1983. According to Wehran (May 1983, "Recommended Remedial Program..."), PAS initially concluded in their draft report that pretreatment of the contaminated groundwater was not necessary. However, in the Final PAS report Sept. 1983), PAS concluded the following:

- The 4-hour groundwater sample contained 43 to 50,000 ppb volatile organic pollutants with 1,2 dichloroethane, methylene chloride and 1,1,2,2-tetrachloroethane at extremely high concentrations. High levels of cadmium, lead, zinc, BOD, COD, TSS, chloride, oil and grease, and iron were also found.
- "The groundwater samples and spiked metal water indicated no toxic or inhibitory effect on the biochemical oxygen demand tests used in the acute toxicity test up to and including a concentration of 83.3%"
- During a 3-day, continuous feed bench scale treatability study, using MCUA activated sludge, at a dilution of 14:1, an initial shock was observed. During this period of 16-24 hours, very poor removal of BOD, COD, TOC, and TSS was obtained.
- In the same test, benzene, chloroform, 1,2-dichloroethane, methylene chloride, toluene, copper, cadmium, lead, and zinc were found to accumulate in the sludge.
- PAS recommended that the inflow rate be reduced or

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pretreatment be conducted to remove purgeable organics and priority inorganics.

In April 1984, HydroQual Inc. submitted comments resulting from their review of the PAS report. They concluded that the experiment was not properly designed and data were misinterpreted. HydroQual's most significant point is that PAS missed the intention of the treatability study. They state that the groundwaters are of a generally dilute nature compared to the MCUA wastewaters. "All priority pollutants are below the adjusted influent limits summarized in the MCUA Industrial Waste Pretreatment Program Technical Report (October 1983). Zinc is proposed at a limit of 2.78 mg/l before adjusting for industrial proportioning. The four hour composite had a zinc concentration of 12.9 mg/l. The MCUA influent has averaged 8.8 mg/l for the past three years."

HydroQual points to a possible mix-up in sample custody or analytical error as explanations for observing a decrease in removal efficiency during the 16-24 hour period of the experiment. HydroQual found that because PAS used distilled water in formulating the spiked metal sample, insufficent consideration was given to the impact of organics in the waste stream. HydroQual also found that the duration of the treatability study, and the lack of a control unit were insufficient to investigate the long term effects of treatment performance.

Based on the data, it appears that HydroQual may have some justifiable concerns regarding the treatability study. No explanation has been given by PAS as to why the removal efficiency would have dipped during the period of 16-24 hours. Also, a longer study, and the addition of a control unit would have allowed greater confidence in the data and the study results. However, HydroQual's concerns are not sufficient to dismiss the PAS study entirely. Until a new study is conducted, or until further information is obtained regarding the PAS study, the potential for toxic, inhibitory, or residual impacts on the treatment system cannot be dismissed.

In the administrative order of April 27, 1988, it appears that the burden of addressing these concerns has been shifted to the MCUA. CPS and Madison are to permitted to discharge the pumped groundwater to the MCUA via the Old Bridge Township Sewerage Collection System (OBTSA). "A direct discharge ...will be allowable provided appropriate permits and approvals are obtained from the MCUA and NJDEP." The order requires that the groundwater from recovery well T-1 and process waste waters of Madison be pretreated for zincand that any plans and specifications for the construction of the discharge system and/or pretreatment system be submitted to the MCUA and OBTSA prior to construction. A secured metering and sampling vault shall be provided. The pretreated groundwater is to monitored according to the the regulations of the MCUA.

Comment. At this time, it is unknown whether the MCUA is aware of the concerns raised by PAS (or HydroQual), what requirements the MCUA may have for establishing conclusively the impacts on their system, the effluent discharge limits they would impose, and thereby the level of pretreatment which would be necessary.

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2.1.6 DETAILED ANALYSIS OF ALTERNATIVES

A detailed analysis of alternatives is the third stage of the FS. The 1981 Order outlined the following remedial program based on the 1980 Dames & Moore investigation:

- slurry cut-off wall tied into a continuous natural clay layer at a depth of 70 feet or more.
- 4 maintenance wells inside the slurry wall, 4 decontamination wells outside the slurry wall, pumping at a rate of 1 MGD for 4 years (total 1,460 million gallons).
- construction of a force main to the MCUA sewer system.
- monitoring wells plus sampling and laboratory analysis.
- the rerouting of Pricketts Brook.
- dredging and disposal of contaminated sediments from Pricketts Brook and Pricketts Pond, and
- the pumping out of Pricketts Pond.

A series of reports subsequent to the report of Dames & Moore comments on and criticizes the alternative chosen in the Order and serves as a detailed analysis of alternatives, as suggested by EPA guidance. A summary of those reports is presented in this section. According to EPA guidance, the following nine criteria should be considered during evaluation of alternatives:

- Short-term effectiveness
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Implementability
- Cost
- Compliance with ARARs
- Overall protection of human health and the environment
- State acceptance
- Community acceptance

Converse Consultants

As requested by Madison Industries, Converse examined an alternative scheme (Alternative 1) which separates the metals contamination problem from the organic contamination problem, and presumed that independent programs will be undertaken by the two companies. However, Converse felt that this scheme was impractical because the sources are too close to each other to facilitate independent clean-up. The exercise was undertaken to determine the allocation of costs and Converse concluded that Madison Industries would benefit.

Based on data from borings (Geraghty & Miller, 1978) and test wells

(Woodward-Clyde) and an affidavit from J. Kolmer of Woodward-Clyde (May 1981), Converse refined the alternatives set forth previously and presented 2 other alternatives (Alternative 2 and 3). Alternative 2 was designed for the same areas and volumes as the previous alternatives developed by Dames and Moore, while Alternative 3 includes an extension of the slurry wall to surround Pricketts Pond. Due to lack of evidence for a continuous clay layer beneath the site, Converse suggested the use of a partial slurry wall (i.e. a slurry wall approximately 50 to 60 feet deep that doesn't necessarily tie into a clay layer at depth, but into a less permeable material). Converse points out that the slurry "bath-tub" would cutoff the natural flushing effect on infiltration of precipitation or the injection of water. Second, Converse calculated that the bath-tub would be pumped dry in less than one year using 4 wells operating at about 100 gpm each. Finally, the contaminants remaining within a "bath-tub" constitute a long-term source of pollution.

In their report for Madison (May 27, 1983), Converse suggested installing an interceptor well upgradient from T-1. These two wells would then be pumped at 150 gpm each for a total of 300 gpm. Converse suggested operating T-1 at 150 gpm in order to prevent downgradient migration of metals from the area of high concentration.

Wehran Engineering

At the request of CPS, Wehran (May 1983) evaluated site conditions and the remedial plan suggested by NJDEP and described in the Order of 1981. Wehran then evaluated whether a more cost-effective alternative exists. Wehran's investigation was based on the following factors:

-Dames and Moore in their 1980 report estimated that 10 to 30 "flushings" of the aquifer would be required to purge the aquifer of the organic and inorganic contaminants. More current knowledge of the fate and transport of contaminants in the groundwater system indicates that this estimate is high.

-current stratigraphic data has revealed that the South Amboy Fire Clay is not continuous beneath the study area. It would not, therefore, serve as an effective confining layer in which to key the proposed cut-off wall. Consequently, to be effective, the wall would have to penetrate to the deeper Woodbridge Clay, thereby greatly increasing the cost of the cut-off wall.

-new data generated by the NJDEP and others since the Superior Court's decision has opened up new avenues for more cost-effective remedial action.

In addition to further investigation of the area's hydrogeologic conditions, Wehran employed a groundwater flow computer model developed by the U.S. Geological Survey (Trescott, Pindev, Larson, 1976). The purpose of the model was to evaluate the hydrogeologic impact of potential remedial options and help in the development of the alternative presented by Wehran.

After modeling the hydrogeologic system, Wehran simulated a recovery system

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necessary to intercept the plume of contamination. Wehran suggested that a recovery well located in the vicinity of Pricketts Pond could take advantage of the natural convergence of groundwater flow at the head of the pond. They determined that a pumping rate of nearly 1500 gpm is required to intercept the plume. In order to reduce the pumping rate to 300 gpm, Wehran suggested the addition of a crescent-shaped slurry trench cut-off wall extending across the head of Pricketts Pond. The design of the cut-off wall would be dependent on the depth to the underlying aquitard. This depth (to the South Amboy Fire Clay) was estimated to be 50 feet in the vicinity of Pricketts Pond.

From the seepage velocity equation, Wehran estimated that the maximum amount of time for a particle of water to travel from the upgradient site boundary to the recovery well is on the order of five years. Combined with their estimate of four flushings to remove the dissolved heavy metal contamination, it would take 20 years to clean the aquifer at a pumping rate of 300 gpm. Wehran conservatively estimated that the system would remain operational for a period of 50 years, during which ten aquifer pore volume exchanges would occur.

With an anticipated pumping rate of 300 gpm, the available capacity of the Old Bridge Township sewer line would not be exceeded. The potential for discharge to the MCUA treatment plant via the sewer line would become available. This would negate the need for an on-site treatment system, according to Wehran.

Wehran estimated the cost of the remedial program over the estimated 50-year operational life of the system. Total construction and operation and maintenance (O&M) costs (present worth, 50 years) for the following activities were estimated to be much lower than the Dames & Moore plan:

-Groundwater recovery system
-Pricketts Pond cut-off wall
-Pricketts Pond Dredge and Disposal
-Discharge and treatment (MCUA)
-Monitoring Program

Wehran, Addendum and Addendum No. 2

At the request of NJDEP, Wehran modified their original plan twice. The first addendum (June 21, 1983) addressed two concerns of NJDEP: the influence of the stream diversion as designed by NJDEP and the effectiveness of higher pumping rates on expediting aquifer purging.

With the same model type, procedures, grid, boundary conditions, and assumptions used in their original scheme, Wehran simulated the effect of the relocated stream channel. They found that flow along the southern edge of the plume would be deflected toward the stream and not intercepted by the recovery well. Wehran found that with a shallower intersection of the water table the stream would not influence groundwater contours. (Wehran did not present the raw data of their simulantions in their report.)

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Wehran stated that an alternative to raising the grades of the stream is to relocate the stream further south as proposed by Converse (March 4, 1982). Wehran did not feel it was necessary to model this alternative since the proposed location places the stream well beyond the study area.

Also in the addendum, Wehran evaluated two pumping options in addition to the 300 gpm pumping from the proposed Pricketts Pond recovery well. Modified Remedial Program A added pumping from existing well T-1 at rate of 150 gpm for a total of 450 gpm. Modified Remedial Program B included these two wells plus pumping from wells at the location of WCC-6 and MI-3, each at a rate of 125 gpm for a total recovery of 700 gpm. These simulations were made with the influence of Pricketts Brook removed by one of the above alternatives.

Based on their original estimate of 4 flushings needed to remove the contamination, Table 2.2 relates each alternative to the minimum renovation time.

Table 2.2
Summary of Alternatives

Alternative	Combined Pumping Rate	Minimum Renovation Time
Original Wehran Plan	300 gpm	15.2 years
Remedial Program A	450 gpm	8.0 years
Remedial Program B	700 gpm	6.4 years

(from Wehran, June 21, 1983)

Wehran's second addendum (March 28, 1984) was intended to address NJDEP's suggestion for two pumping wells (in addition to well T-3, the Pricketts Pond recovery well) located near the sources of the plumes.

Wehran simulated the effect of pumping upgradient wells T-1 and T-2 at a rate of 50 gpm each and T-3 at a rate of 300 gpm for a total of 400 gpm. Wehran estimated that contaminant travel times (i.e., the times necessary to purge four volumes of water) would be 12 and 6 years for wells T-3 and T-1 & T-2, respectively.

In the first addendum, Wehran's estimates are minimum renovation times. It was assumed that each flow regime would act independently with respect to the time necessary to purge the aquifer. In the second addendum, however, it is assumed that T-3 would capture all flow paths. In other words, the second addendum provides a more conservative estimate of 12 years (compared to 8 years and 6.4 years time for remedial plans A and B of the first addendum).

The second addendum provided no new information concerning the other aspects (e.g. re-routing of Pricketts Brook) of the clean-up.

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CH2M Hill

In August of 1984, CH2M Hill presented their evaluation of the original remedial design (Dames & Moore, 1980) which included the "bath-tub" slurry containment wall. This study, however, post-dates designs originally proposed by NJDEP and presented by Wehran (May 1983; June 1983; March 1984). These have adopted a crescent-shaped slurry wall in place of the "bath-tub" due to the discontinuity of the South Amboy Fire Clay and the depth of the next deepest confining layer (the Woodbridge Clay).

Basically, CH2M Hill suggested enlarging the bathtub to include the entire zone of contamination. This, they say, would rule out the need for any additional recovery wells located outside the wall (Figure 6).

Geraghty & Miller

On behalf of Old Bridge Township, Geraghty & Miller (November 6, 1986) reviewed and evaluated Wehran's remediation plan. Geraghty & Miller noted that Wehran's plan (including the second addendum dated March 28, 1984) was based on the extent of groundwater contamination as defined by data collected in March 1982. Not having reviewed any recent data, they implied that the plume may have migrated since 1982 and that the proposed slurry wall and recovery well system may not capture all of the plume. Thus, a portion of the plume may continue to migrate, uncontained to the southwest. They suggested that more recent data on the extent of contamination be reviewed or obtained before deciding on the location of the slurry wall.

Geraghty & Miller were also concerned about the downward migration of contamination through either the South Amboy Fire Clay or the Woodbridge Clay.

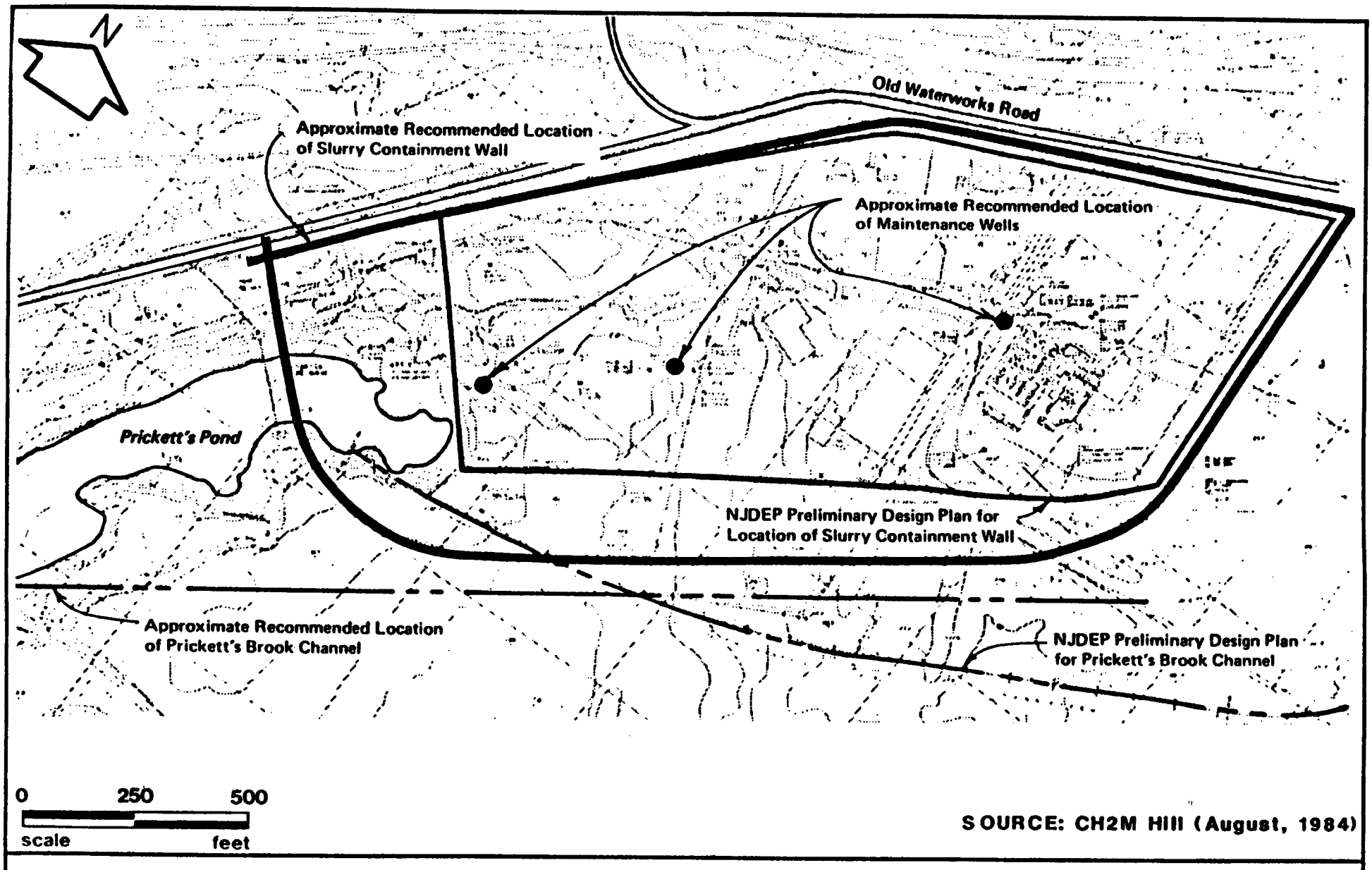
Summary of Comments by CDM FPC

Comment. Wehran did not provide cost figures to support their conclusions about alternatives. Wehran states that Remedial Plan A represents a 50 percent increase in pumping rate and a 50 percent increase in cost. CDM FPC suggests that, since well T-1 already exists, a 50 percent increase in cost may be an overestimate. Wehran states that Remedial Plan B reduces the renovation time by only 1.6 years. However, compared with the original plan, Plan B provides for a 60 percent reduction in renovation time. A cost analysis should have been provided by Wehran in order to evaluate the cost effectiveness of the two modified remedial plans.

Comment. Wehran did not adequately compare the three alternatives discussed in their first addendum in accordance with Chapter 7 of EPA's RI/FS guidance document (EPA, March 1988 DRAFT).

Comment. Wehran did not provide a cost analysis in their second addendum.

Comment. The plan suggested by CH2M Hill does not satisfy the following evaluation criteria of EPA guidance: effectiveness and overall protection of human health and environment, due to the lack of a continuous clay unit across the site.



SOURCE: CH2M HILL (August, 1984)

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Figure 6

Location Of Slurry Wall, The "Bath Tub" Plan

CPS/ Madison, Middlesex County, New Jersey

Comment. CDM FPC questioned NJDEP (October 27, 1988) concerning the downward migration of contamination through the clay layer into the Sayreville Sand. NJDEP contends that the Sayreville is not threatened by downward migration of contamination. The six deep wells being installed in 1988 by Wehran prior to final design will not go through the South Amboy Fire Clay. According to NJDEP, the reason for this is that the Sayreville in the area of well installation is thin (approximately 10-20 feet) and discontinuous, so that the South Amboy Fire Clay is, in a large part of the area, directly underlain by the Woodbridge Clay. NJDEP also mentioned that there was some concern in introducing contamination into lower units by drilling deeper than the South Amboy Fire Clay. The purpose of the 1988 wells is for determining the final location of the slurry wall, so that the plume is completely captured upgradient of the wall.

2.2 CERCLA, SARA, AND THE NCP

On October 17, 1986 SARA was signed into law as an extensive amendment to CERCLA of 1980. Major goals of SARA include a faster pace of cleanup, more public participation, and more rigid and clearly defined cleanup standards. CDM FPC has evaluated the CPS/Madison site cleanup for compliance with CERCLA, SARA, and the NCP. This section addresses CDM FPC's concerns about the site's compliance with statutory requirements.

2.2.1 CLEANUP STANDARDS (SARA 121; CERCLA 121(a)-(d))

SARA emphasizes achieving remedies that permanently and significantly reduce the mobility, toxicity, or volume of the hazardous substances themselves, and to remedies using alternative treatment technologies. Off-site transport and disposal of hazardous substances without treatment is designated the least favored alternative.

With regard to CPS/Madison, provisions for cleanup standards required by SARA must be considered in light of anohter requirement of SARA, which is the expedition of cleanup (SARA 116; CERCLA 116). SARA requires EPA to begin remedial action at 375 Superfund sites over the five-year reauthorization period (at 175 NPL sites by October 17, 1989; at 200 additional sites by October 17, 1991).

In addition to this requirement, there is increasing pressure from the public to initiate cleanup of a site first identified in the early 1970's and on the NPL since 1982. The State has received much criticism from the public for interfering with the 1981 Order to remediate in lieu of what the State considered a better alternative (the cresent shaped slurry wall). Numerous newspaper articles and correspondences explain the public's perception in more detail. (These articles are listed in the appendix of this report.)

It is apparent from these articles and other documents concerning CPS/Madison that there are at least two factors - in addition to the time needed to conduct a detailed analysis of each alternative - which may be responsible for the delay in implementing a remedial plan. Judge Keefe (who issued both the 1981 and the 1988 Orders) pointed to "court delays" in an article in the Star Ledger (January 28, 1988). According to Judge Keefe

the dispute over the two plans exemplifies why the courts are "ill-equipped" to handle pollution matters because of motions, studies, briefs, trials, and appeals.

A second factor for the delay was the City of Perth Amboy's refusal to accept the crescent shaped slurry wall as a viable remedial alternatives. Perth Amboy felt that the crescent would not properly contain the contamination. Furthermore, newspaper articles indicate Perth Amboy's dissatisfaction with a plan which would cost CPS and Madison less money that the first option, in light of the fact that evaluation of the second alternative would result in a delay in cleanup (the Home News, November 12, 1986).

In sumary, it seems that Perth Amboy has blamed CPS and Madison for the delay and CPS and Madison have blamed Perth Amboy. The public has criticized the State.

While the remedial plan ordered by the Court in 1988 does not introduced alternative treatment technologies (technologies which are fully developed but lack sufficient cost or performance data for routine use at Superfund sites), it is designed to reduce the toxicity, volume, or mobility of the hazardous substances as required by SARA. Documents reveived by CDM FPC indicate that the "bath-tub" plan would not satisfy this requirement, due to the discontinuity of the South Amboy Fire Clay.

SARA requires that the selected remedial alternative satisfy ARARS. The current plan appears to satisfy this requirment in that New Jersey State groundwater quality standards or background levels are to be met. The cleanup standards referred to in the 1988 Order are the Safe Drinking Water Act levels for heavy metals and for volatile organic compounds, as well as newly promulgated standards.

2.2.2 HEALTH ASSESSMENTS (SARA 110; CERCLA 104(i))

The ATSDR is required by SARA, to the maximum extent practicable, to perform a health assessment at each NPL site, generally prior to the completion of the RI/FS for each site. On September 8, 1988 ATSDR contacted NJDEP for information to be used to conduct an endangerment assessment.

2.2.3 PUBLIC PARTICIPATION (SARA 117; CERCLA 117)

SARA requires that EPA or the State provide opportunity for the public to comment on any proposed plan for remediation. EPA is authorized to make grants of up to $50,000 to help individuals affected by sites listed on the NPL obtain technical assistance in interpreting the information made available.

The Citizens Advisory Committee (CAC) is stationed in the Township of Old Bridge and composed of appointed representatives of the communities of Old Bridge, Perth Amboy, and Sayreville. The CAC is reponsible for ensuring that the remedial plan to be implemented at CPS/Madison protects the public's interests.

Recently, it appears that the community (i.e. the CAC) has been very involved in the remediation proceedings. However, a letter to NJDEP (February 4, 1985) from Blanche Hoffman, the CAC Chairwoman, and a newspaper article (Judy Peet, the Star Ledger, undated) indicates that there was a period when information on the remedial plan was withheld from the public. According to the article, the NJDEP admitted that the public had been denied access because of "sensitive negotiations." NJDEP Assistant Commissioner George Tyler stated that "negotiations often benefit from not being conducted by public hearing...especially when you are dealing with defendents you don't trust'" Tyler testified at a public hearing in Old Bridge, called by the Assembly Legislative Oversight Committee to investigate the delay in cleanup.

In a letter from Blanch Hoffman, also Chairwoman of the Old Bridge Environmental Commission, to Christopher Daggett, EPA (June 30, 1987), a request was made for a grant from Superfund. The $50,000 grant (for is to be used for technical assistance at CPS/Madison.

2.2.4 THE NCP

CERCLA required that procedures be established to evaluate remedies, to determined the appropriate extent of the remedy, and to ensure that remedial measures are cost effective. In accordance with CERCLA 105, EPA established these procedures in subpart F (40 CFR 300.61-300.71) of the NCP. The following are considerations from the NCP which should be addressed with regard to CPS/Madison.

According to 40 CFR 300.67, the lead agency is responsible for developing and implementing a formal community relations plan. Although documents reviewed by CDM FPC indicate that the CAC is well-informed of the activities leading to remediation, there is no indication that a "formal" plan has been developed. According to Paul Harvey of NJDEP, a CRP is planned, and will be implemented once the design is completed.

In light of Geraghty & Miller's comment that the effectiveness of the crescent shaped slurry wall is dependent on the present extent of contamination (and not the extent as defined by data from 1982), the remedial plan may be in violation of 40 CFR 300.68(g)(3). The remediation must be designed with regard to the current (horizontal and vertical) extent of contamination.

In order to satisfy the requirements of 40 CFR 300.68(k), a quality assurance/site sampling plan must be written. The sampling plan must address all of the concerns of 40 CFR 300.68(k) and must be designed with regard to the remedial plan described in the Order issued in 1988.

3.0 SELECTION OF A REMEDY

In April 1988 the Superior Court of New Jersey issued an order to amend its June, 1983 judgment, which had been questioned by NJDEP, CPS, and Madison. The 1988 Order provides for the implementation program proposed by Wehran and Converse on behalf of CPS and Madison.

A groundwater recovery system will be installed by CPS and Madison as outlined by Wehran (1984) (Figure 7). This plan includes a cresent shaped slurry wall keyed into the South Amboy Fire Clay approximately one third of the distance downstream into Pricketts Pond. Borings estimated the depth of the South Amboy Fire Clay at 30 to 70 feet. Three recovery wells will be employed to intercept the contaminated groundwater plumes. The effectiveness of this system is contingent upon the relocation of Pricketts Brook south of the CPS/Madison site as proposed by Converse (May 27, 1983).

Groundwater pumped from the recovery wells is to be discharged to the MCUA treatment plant in Sayreville via the OBTSA collection system. CPS and Madison are required to pay all applicable connection and user charges assessed by the MCUA or OBTSA. Direct discharge of the wastewater will be allowed provided the appropriate permits are obtained from the MCUA and the NJDEP. Wastewater from Madison must be pretreated for zinc by Madison to achieve 80% removal of zinc.

The 1988 Order does not require the removal of sediments from Pricketts Pond or Brook; however, the need for such action must be re-evaluated by CPS and Madison after the remedial program is operational.

CDM FPC contacted NJDEP to inquire about the present status and schedule of remediation. According to Paul Harvey of NJDEP, 13 additional wells are being installed, and an entire round of sampling will be undertaken. These wells are shown in Figure 8 as DW-1 through DW-7. These wells are couplets (shallow and deep), with the exception of DW-2, which is a shallow well. A pump test will be conducting to determine aquifer properties. The model will then be refined and the wall will be designed. These activities are scheduled for the beginning of 1989.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Due to the long duration of the investigation at CPS/Madison and the large number of separate investigations conducted by the State and outside consultants, the responsible parties have generally satisfied (albeit reluctantly) the requirements of CERCLA, SARA, and the NCP, as well as EPA guidance on conducting RI/FSs. However, several deficiencies remain, and the following points must be addressed in order to completely satisfy EPA policy.

o The current nature and extent of contamination must be clearly defined. This could be accomplished by a complete round of sampling groundwater prior to final remedial design. The samples should be analyzed for the TCL in accordance with the CLP. A complete round of sampling is planned, according to NJDEP, but there is no plan for a TCL analysis (personal comm., October 1988).

o A risk assessment should be performed in accordance with the SPHEM (EPA, October 1986), as per EPA guidance on conducting RI/FSs.

o A health assessment must be completed by ASTDR, as per SARA Section 110. (It is in progress according to NJDEP.)

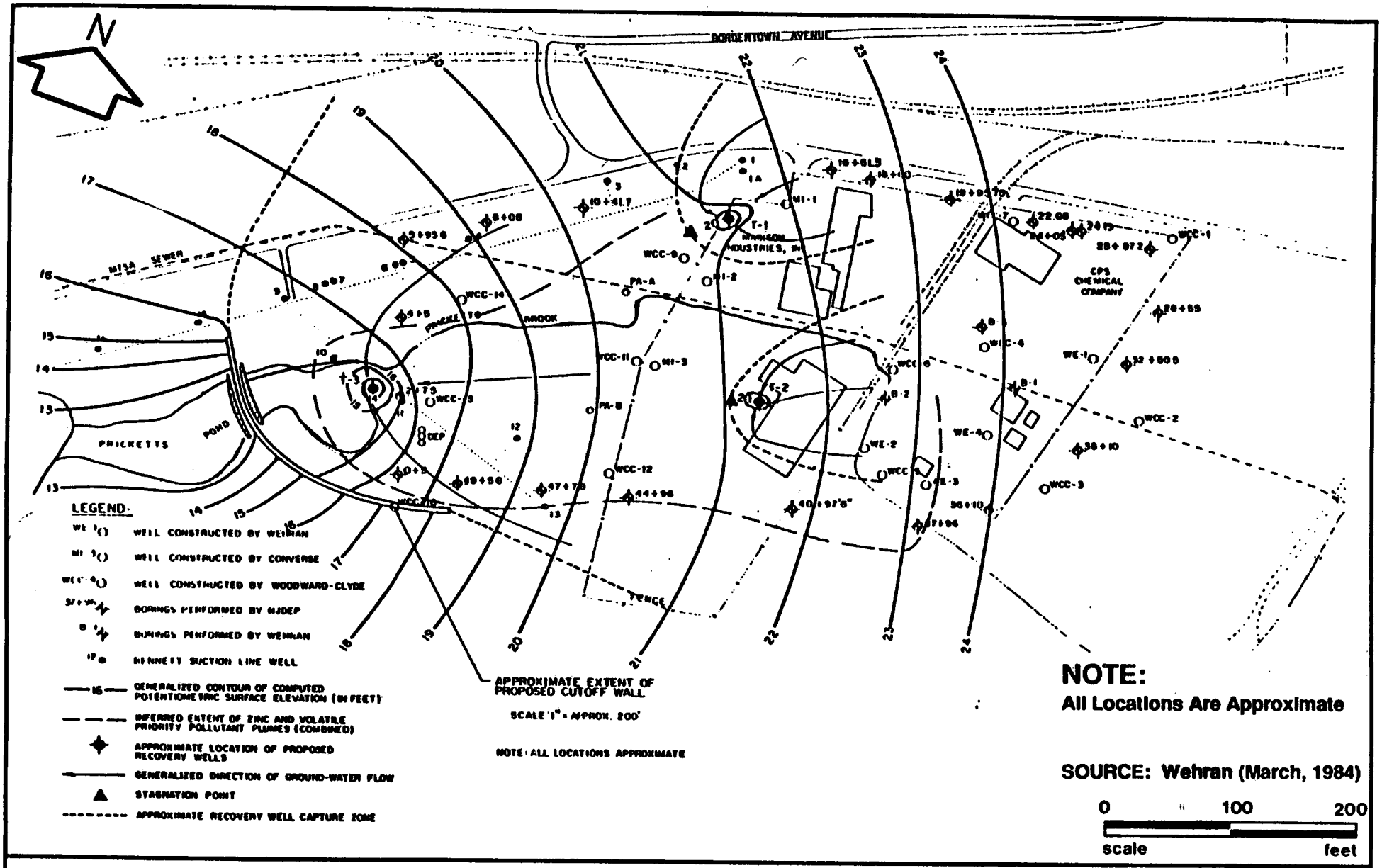

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Figure 7

Predicted Aquifer Response To Crescent Shaped Slurry Wall Plan

CPS/ Madison, Middlesex County, New Jersey

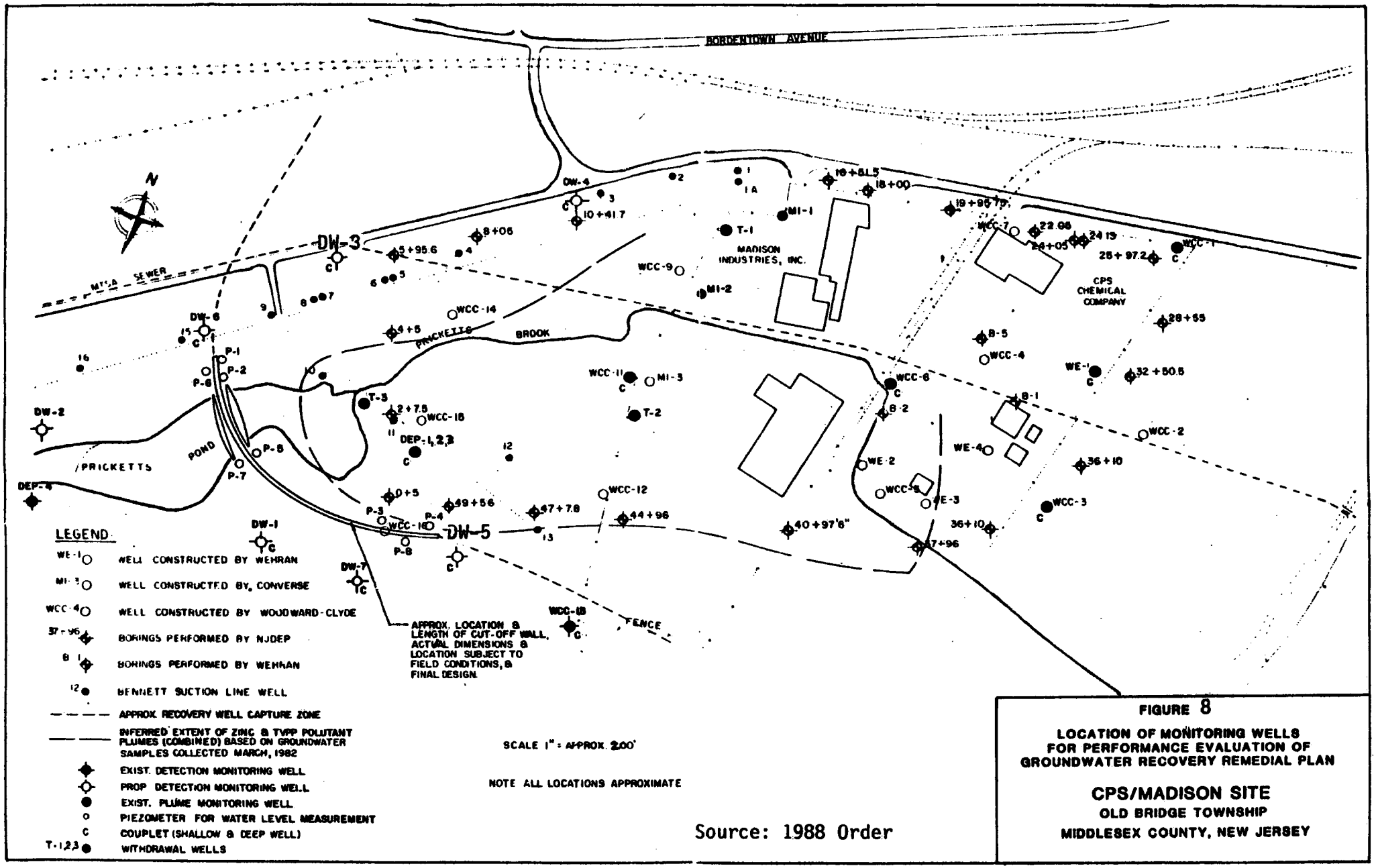

FIGURE 8

LOCATION OF MONITORING WELLS FOR PERFORMANCE EVALUATION OF GROUNDWATER RECOVERY REMEDIAL PLAN

CPS/MADISON SITE

OLD BRIDGE TOWNSHIP

MIDDLESEX COUNTY, NEW JERSEY

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- A CRP must be implemented, as per SARA Section 117.

- ARARS must be continually updated as remedial actions proceed, as per EPA guidance.

CDM FPC recommends that lead and support agencies continually monitor remedial actions. Also, the data collected in the past should be tabulated to aid in the final design. This table should be updated as new data is collected.

Finally, the lead and support agencies should bear in mind that a major requirement of SARA is a fast pace of cleanup. Contamination was first identified in the early 1970's, and the site has been on the NPL since 1982. The affected community has been critical of the companies, as well as NJDEP, for the delay in cleanup. The site receives much media attention, and expedition of cleanup is in everyone's best interests.

(JMM/23)